

*Thomas Hodgkin Esq.*  
*With the author's kind regards*  
(8.) CONTRIBUTIONS

TO THE

SURGERY OF DISEASED JOINTS,

WITH ESPECIAL REFERENCE TO

THE OPERATION OF EXCISION.

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No. 1.—THE KNEE.

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Illustrated with Engravings on Wood.

BY

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## PREFACE.

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THE accompanying pages consist of a reprint of a few Essays which, during the past two years, have appeared in the columns of the *Lancet* and *Medical Times and Gazette*. They are collected and published in a separate form, with the hope that the facts therein enumerated may prove of some value to those Surgeons who take an interest in the treatment of Diseased Conditions of the Knee-joint, by the operation of Excision.

7, GREEN STREET, GROSVENOR SQUARE,

May, 1859.

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OBSERVATIONS ON THE TREATMENT OF STRUMOUS DISEASES OF THE KNEE-JOINT BY THE OPERATION OF EXCISIONS.

IN a paper which I had the honour of communicating to the Medical Society of London, at the commencement of the year 1857, I endeavoured to attract more general attention to the operation of removal of the knee-joint, and to point out some features of interest connected with various forms of disease of the articulation which, with advantage to the patient, and to the credit of surgery, could be removed with comparatively slight mutilation of the body.

The observations I then offered were essentially of a practical character, and were advanced with the view of destroying prejudices held by many, whose concurrence was needed to enable a more general acceptance of the operation, and to curtail (in the words of the younger Moreau) "that destructive routine of ordinary practice, that cuts off a limb, as it were, by storm, which, by an operation wisely bold, might have been saved." Those diseases commencing in the synovial membrane, and subsequently involving cartilaginous, fibrous, and bony structures, were shown to be frequently well adapted to the operation, provided there existed no very acute symptoms, or any decided constitutional diathesis.

But there presents a class of cases, unfortunately of common occurrence, in which removal of the articulation on many occasions, becomes questionable. I allude, particularly, to those instances in which great destruction of osseous texture accompanies or precedes the mischief immediately affecting the joint. It is well known that this articulation may become involved in various ways. The

disturbance may originate in the tissues external to the joint, and subsequently affect its integrity; or may primarily obtain a footing in the synovial, cartilaginous, or fibrous structures; or, lastly, commence in the cancellous network of the ends of the bones entering into the formation of the joint. It is my intention to confine my remarks to some of those affections which primarily involve the spongy structure of the extremities of the tibia and femur, and, secondarily, include the joint; or which, having originated in the interior of the articulation, subsequently affect to a considerable extent the bony structure. In by far the larger proportion of diseases of the knee-joint which have fallen under my own observation, the mischief has apparently originated in the synovial membrane; and this would appear from general experience to be the most common *locale* for its commencement. Inflammation, however, of a specific form not unfrequently attacks the spongy structure of long bones, and such inflammatory changes are characterised by symptoms which strongly indicate a scrofulous or tuberculous habit of body, and exhibit a local manifestation of the disease. Of late years many excellent pathologists have shown that this form of disease is by no means of uncommon occurrence, appearing especially in the children of the poor, who, for the most part, are ill-nourished and delicate, inheriting, perchance, a specific disposition from their parents, which the more readily encourages the outbreak of the disease. This morbid affection, however, is by no means peculiar to children, and I am inclined to believe that the joints of adults are more frequently destroyed in this way than is generally imagined. As far as I am aware, no surgeon, whose name is associated with removal of the knee articulation, has offered any special comments upon the pathology of this affection, as elucidating and illustrating features of interest in connexion with the operation; and it may not, therefore, be devoid of advantage to inquire how far instances of this disease are amenable to the great conservative proceeding. It is, perhaps, of little

moment, in considering the question, to determine whether, in the majority of cases, the disturbance primarily commences in the spongy texture, or secondarily implicates that structure; neither is it of importance to discuss the exact analogy of strumous deposit in bone to genuine tubercle, as the interest of the subject may be better consulted by considering the disease under the character of a morbid material which partakes more or less of the nature of struma as developed in other localities of the body.\*

The infiltration of the spongy structure of bone by this strumous material may be of two distinct kinds, *circumscribed* and *diffuse*; and it is all-important that these varieties be duly understood by the surgeon who lends encouragement to the modern proceeding of excision.

Firstly, with regard to the *diffuse* variety. The morbid process is ushered in by a general low inflammatory state of the open network of the bone, the surface so affected appearing congested, and of a dark red colour, owing to the medulla contained in the bony cells being mixed with blood. This condition may sometimes be recognised by the increase of temperature about the parts so involved, and by a sensation which, if not amounting to absolute pain, is sufficient to attract not only the fears of the patient, but the attention of the surgeon. Both these symptoms may obtain in degree according to circumstances; and I have noticed, on several occasions, that the disposition to annoyance is more marked in patients of a plethoric habit of body than in those who labour under a more sallow and cachectic disposition.

If this condition into which the affected parts have fallen be recognised, it is not impossible, by judicious treatment, to arrest the further development of the disease; but should it continue, organic changes soon follow, which rapidly involve the integrity of different structures. When this inflammatory condition is well established, the cells of the bony structure

\* In the current numbers of the *Edinburgh Medical Journal* for 1859, will be found some able Essays upon "The Pathology of Tuberculous Bone," by Dr. Cornelius Black.



not only appear congested, but subsequently contain a substance more or less fatty, oily, lardaceous, or gelatinous in consistence; and, provided the morbid action has obtained to the medullary cavity, the medulla itself may become the seat of disease. The bony network soon becomes implicated, inflames, expands, and softens, and to such an extent, that it may easily be broken down by the slightest pressure.

This further increase of the disease is accompanied by a chemical alteration in the constituents of the bone. The earthy material, which in health forms so considerable a portion of the osseous composition, greatly diminishes, and, in some instances, almost entirely disappears. Not only are the parts so involved deprived of their inorganic material, but the compact structure immediately surrounding them likewise becomes affected, and converted into a mere shell, possessing apparently little similitude to normal bone. The periosteal covering also sympathises, thickens, and loosens in its attachment. When this morbid affection is confined to the extremity of the shaft, the further changes that may take place are dependent on, and modified by circumstances. The disease may appear suddenly to be arrested, and to call for little aid from the surgeon. If, however, the inflammatory state of the parts has somewhat subsided, liquefaction of the tuberculous or strumous deposit may slowly and gradually take place, accompanied with ulceration, which destroys the cellular structure of the bone, and advancing towards the more compact, perforates the already thinned walls. But it not unfrequently happens that the deposition of the foreign material leads to more extensive and rapid mischief. Suppuration may supervene upon a fresh attack of inflammation, and with celerity not only destroy contiguous parts, but give rise to an amount of suffering and distress which seriously affects the already debilitated constitution, and demands the adoption of decisive measures. When either or both of these conditions have obtained, a communication with the surrounding soft tissues is soon effected. The irritating matter being voided



into cellular and other structures, favours the formation of abscesses, which, when opened or bursting of themselves, admit the exit of a discharge composed of the softened strumous material, more or less mixed with blood, pus, and the débris of carious or necrosed bone. It would appear from the above description, that this form of disease may exist for some time, or even run its course, without including the neighbouring articulation; but, unfortunately, it is seldom that the joint escapes the destructive process. At an early period the articulation begins to sympathise, and ere long becomes seriously affected. When the first stage of the disease is well established, and the foreign material which has been deposited in the cancellous texture begins to soften, the boundaries of the joint are invaded. By changes degenerative and destructive the cartilages disappear, and permit the extrusion of the morbid contents of the diseased bone into the joint cavity. The synovial membrane, if not already involved, thickens, and greatly alters in structure; its functions are destroyed, and, instead of fulfilling its proper duties, becomes the cause of more serious implication. The ligaments, put upon the stretch by the increasing size of the joint, soften, and permit deformity and luxation to take place. The presence of irritating matter in the closed cavity soon leads to suppuration, and perforation of its walls. Thickening and abscesses include cellular and other tissues, and ere long circuitous channels are formed, with external openings, which admit the escape of the cause of so much disturbance.

The accompanying woodcuts of the knee-joint of a little girl, destroyed by this form of disease, which I was compelled to remove by amputation of the thigh, well illustrate many of the features to which I have briefly alluded.\* The disease, in this instance, commenced in the head of the tibia, and succeeded in converting that bone into a vast cavern,

\* These and accompanying illustrations are from the graphic pencil of Dr. Westmacott, Delineator of Anatomy and Pathology in King's College, London.

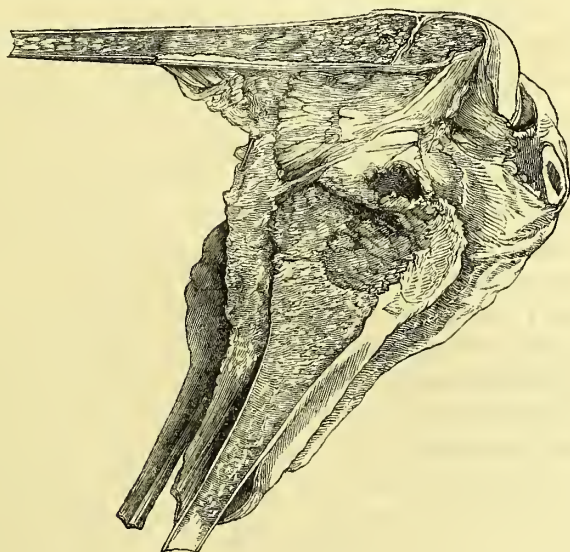
destroying to a great extent the osseous walls, and disorganizing the joint, by implicating the articular cartilages and other structures.



The same form of disease existed in the lower end of the femur; but, as is well shown, the articular extremity of the bone is unimpaired, while the shaft to some extent is rendered carious by ulceration proceeding from within, with extensive alteration in its periosteal covering. The arrest of development in all three bones is likewise clearly perceptible.

Such, in general, are the stages through which this form of the disease may run, and the question of interest is, how far this affection is curable? Mr. Stanley has well remarked, in his excellent treatise on "Diseases of the Bones," "that the disease is perfectly curable only in its first stage, when the changes in the bone have not passed beyond those of simple inflammation;" and, I think, general experience will not negative the assertion, that the reproductive process never follows the implication and destruction of bone by this diffuse form of strumous disease. The disease having passed to that stage

which is incurable by nature, it may remain a question as to how far any operation, short of removal by amputation, is of



any avail? I fear even the most strenuous advocates for excision of this articulation can find but little encouragement to adopt a proceeding, the ultimate result of which must, in all probability, prove futile to the patient, and deleterious to the cause of conservative surgery.

Of all morbid affections, perhaps, there is no one class more difficult of correct appreciation than diseases of joints. Daily experience proves how utterly impossible it is, on many occasions, to form a right estimate of the extent to which both hard and soft tissues are involved, to point out the exact seat of disturbance, or to diagnose the nature of the affection which calls for so serious an interference as amputation or excision.

I have not unfrequently seen limbs removed for a comparatively slight amount of disturbance in the joint which was deemed irreparable prior to being amputated, and, often-

times, I have witnessed the operation, where the extent of disease was supposed to be much more trivial than subsequent examination showed. Whenever, therefore, there is the least doubt as to the nature and amount of disease in a condemned joint, I conceive the surgeon will be acting with discretion in obtaining a clear view of the interior of the articulation, prior to making up his mind as to the nature of the operation he is about to perform. Old prejudices must be done away with, and ancient practices effaced. The time has arrived when routine, so detrimental to the cause of humanity, should be abolished, and customs, doubtless excellent in their day, no longer remain unquestioned.

Many, I know, will and do object to what may seem an unnecessary prolongation, and a somewhat new innovation to the steps of an operation, and will argue that such a proceeding is fraught with additional risk to the patient. But such fears are more imaginary than real. Mr. Butcher has well considered this point in his last excellent memoir, "On Excision of the Knee Joint;" and since its publication it has fallen to my lot to become acquainted with three more cases, in which the state of the joint was well examined, and actually excised in the hope of retaining to the patients useful limbs, before it was evident that amputation would be the wiser proceeding. If the patient be under chloroform, insensible to pain, separated from passing events, and in the hands of an able operator, I confess, I am unable to see little additional risk that is thereby incurred.

In the memoirs of Mr. Butcher on "Excision of the Knee Joint," several operations have been recorded as undertaken for "strumous disease of the joint." It is to be regretted that the term "strumous" is so frequently used without a more distinctive meaning. I wish particularly to make a definite distinction between diseases partaking of the character of struma, commencing within the cavity of the articulation, and those originating in the cancellous structure of the heads of the bones entering into the formation of the joint. This distinction is all-important; for I do not hesitate to say that



there is scarcely a form of disease of a non-malignant character, confined to the joint, with the exception of that arising from diffuse strumous infiltration of the heads of the two bones, which is not, in general, well suited for the adoption of excision in preference to amputation.

Mr. Butcher gives a short account of eighty-two cases in which the operation of removal of the articulation had been adopted. Not more than a seventh of this number are recorded as strumous, but in every one of these cases, with the exception of a solitary instance, the strumous nature of the disease would appear to have been manifested in the synovial membrane of the joint, or to have appeared in the open texture of the heads of the tibia and femur under that form which is termed circumscribed infiltration.

I have been at some pains to ascertain the pathological condition of the ends of the bones in those cases which are described as "strumous," and my thanks are due to several surgeons for the kindness with which they have answered my inquiries. The solitary instance to which I allude fell under the notice of a most distinguished surgeon, Dr. Keith, of Aberdeen. This case is so full of interest, and as yet unpublished in detail, that I take advantage of the kindness of Dr. Keith, who allows me to use it.

The patient was a man aged thirty-three, the subject of extensive disease of the knee-joint and neighbouring bones, which had existed for eleven months. Excision was performed on March 10, 1855. "One inch and a quarter was taken off the end of the femur, and half an inch from the head of the tibia. The bones were expanded, the interior reddish, and every cell filled with a lardaceous deposit. On sawing through the head of the tibia, an abscess in the very centre of that bone was opened, from which a teaspoonful of ripe pus escaped, leaving a thimble-shaped cavity. Three abscesses outside and around the joint were also laid open." The account forwarded to me by Dr. Keith is so graphic, that I cannot avoid transcribing it:—

"Well, this case got every care that my skill could

devise. I was dresser myself, and fought on for 222 days, and at last, to save his life, gave in and amputated the thigh on October 20, 1855; and on November 30 he was dismissed cured, and at this date (May 1857) commands a trading brig out of the port of Aberdeen, walking on an artificial limb."

The ends of the bones in this very interesting case, exhibited all the distinctive characters of destruction by diffuse strumous infiltration; and the conclusion arrived at by the operator is so just, that, should no companion case be brought forward, it may serve as a beacon to warn those less experienced from attempting a similar proceeding. "Reason told me so (I was wrong) before I operated; but I tried it. I thought an open joint, with the free discharge, and irritation lessened—that good keep, and other suitable treatment, might remedy even the disease of the bones; but no, no."

From the details of this single case it would appear that the operation of excision is not adapted for the treatment of knee joints destroyed by diffuse strumous infiltration of the articular extremities of the tibia and femur; and such a conclusion is, I believe, fully justified.

The two great objects to be obtained by excision of a diseased articulation are—removal of every trace of disease, and the retention of a good and useful limb. To ensure the former requisite it is absolutely necessary that such cases only should be submitted to the operation in which the nature and extent of the disease is clearly and distinctly ascertained not to involve a greater amount of structure than can be removed with propriety. Unfortunately, the diffuse form of strumous infiltration, in the majority of instances in which it destroys the integrity of the knee articulation, is too extensive to be entirely removed, and, therefore, the operation is decidedly inappropriate for this class of disease.

That the patient may possess a useful limb, in every way superior to a wooden substitute, it is imperative that the cut surfaces of the bone should be firmly bound together by union

of such strength as will enable all the motions of progression to be performed with comfort and facility. It is by no means absolutely necessary that the bond of union should be completely osseous in character, although I am aware that many, not particularly well informed on this interesting subject, deem such a termination indispensable.

I am acquainted with instances where an admirable degree of usefulness is afforded by limbs in which union of the surfaces of bone is, if not altogether, in a great measure fibrous and flexible: and it is not improbable that ere long it may be deemed desirable to retain a certain degree of motion, instead of obtaining a firm osseous ankylosis. But it is questionable if reparation, even of the latter kind, will take place between the exposed surfaces of the two bones. It is tolerably certain that no new bone will be formed, as the mother structures are incapable of accomplishing such repair, and the only junction that could with any reasonable hope be expected, would arise from parts external to the osseous walls. If such cases be subjected to the operation of excision, it will probably be through ignorance of the true state of the affection. Various terminations may follow the unwise adoption. For some considerable time repair may seem to progress favourably. The soft parts may heal to a great extent, but union between the cut surfaces of bone will be slow, and uncertain; and, although experience points to the contrary, hope, and a natural dread of amputation, may for a longer period encourage the patient and surgeon. Or a more serious termination may quickly follow the operation. The diminished vitality of the divided structures, the debilitated constitution of the patient, and the inappropriate manner in which the subsequent treatment is carried out, may favour the lighting up of unhealthy inflammation, which is not improbable to end in destruction of the exposed bone by caries or necrosis. A timely resort to the knife and gouge, may, for a period, avert further mischief. This has happened once in my own practice, and the removal of the dead portions of bone was attended with a temporary beneficial result. Ulti-



mately, however, the withering powers of the patient, distressed by constant irritation of an unclosed wound, combined with unhealthy and extensive suppuration, may call for amputation, as in the case recorded by Dr. Keith, and, if the truth were known, as has more frequently happened in the practice of other surgeons.

No generous diet or the exhibition of bone-making material, as phosphate of lime, is sufficient to cure this diffuse form of disease, even when the greater part may have been removed by excision; and, unless future experience shall dictate to the contrary, I must, although an ardent supporter of this great and useful operation, unwillingly give preference to removal of the disease by amputation of the thigh.

It is satisfactory to turn from the consideration of one form of disease, which not only destroys the integrity of an important articulation, but forbids the adoption of a useful and conservative operation, to another phase of the same affection, which, although in its ravages destructive to the functions of the articulation, may be treated with propriety and advantage to the patient by a proceeding milder and more beneficial than amputation.

The *circumscribed* form of strumous or tuberculous infiltration of the cancellous extremities of the tibia and femur, destructive to the functions of the knee-joint, and incurable without operation, is the disease which, I shall endeavour to show, admirably admits, on frequent occasions, of such treatment.

This form of strumous disease of the open texture of cylindrical bones is recognised by most pathologists of the present day; but it is only of late that the importance of a more precise and definite recognition has been practically acknowledged. It was formerly considered of slight import what the exact pathology of the disease which destroyed the integrity of the knee-joint might be, provided no remedy, save removal, could be relied on. The sweep of the amputating knife through healthy parts above the seat of disturbance was held to be the orthodox proceeding; and so firmly

had this doctrine been stamped upon the minds of most surgeons, that, even now, many are still inclined to look upon a nice distinction as of more theoretical than practical utility. Amputation, when resorted to under such circumstances, could not be considered opprobrious; but at the present day, when experience advances facts worthy of belief and imitation, and shows the beneficial results accruing from the adoption of excision, then, beyond doubt, the former proceeding must oftentimes be considered as uncalled-for, and deserving the condemnation of the modern and enlightened surgeon. Such an expression is not the offspring of mere hypothesis, but a conviction based upon the results of cases which have fallen of late years under the care of various surgeons. But for the establishment of a great fact in surgery, it is seldom sufficient to announce the favourable termination attending a new innovation to old-established practice. An explanation of the rationale of a proceeding, the adoption of which has been rewarded with success, is, with justice, expected by those who are inclined to receive with scepticism statements they have not had the opportunity of verifying, or which, on a first announcement, have appeared antagonistic to preconceived ideas of theory and of practice. A due consideration of the morbid changes which take place in the spongy extremities of either of the bones forming the knee-joint will serve to strengthen the validity of such an opinion, and leave less doubt upon the minds of those who have not, perhaps, directed special attention to the consideration of the advantage of this proceeding over amputation.

Mr. Paget, in his excellent Lectures on "Surgical Pathology," has alluded to this form of disease in the following terms:—

"In the circumscribed infiltrations, the tuberculous matter usually forms round or oval masses, which are imbedded in cavities in the interior of the bones. At these cavities, several of which may exist near together, the normal textures of the bone appear to be disintegrated or absorbed, just as those of the lung are during the infiltration of the tuberculous

matter among them. When the liquefaction of the tubercle takes place, a similar imitation of the formation of cavities in the lungs is noticeable, the usual thin puriform fluid is produced, and is often mixed with little fragments of bone. The bony cavity including it commonly becomes lined by a thin, smooth, closely adherent membrane—the product, apparently, of ordinary inflammation. Appearances are thus attained, especially in the bodies of vertebræ, like those of numerous small chronic abscesses in bones; and similar cavities may be found between the bone and peritonæum, where the tuberculous matter has been formed between them, or has included the surface of the bone in its infiltration. The liquid contents of the cavities may be discharged through narrow apertures in the walls of the bones, or other surrounding parts; but commonly a more acute inflammatory or tuberculous formation ensues, destroying both the walls of the cavities and their boundaries.”

The chief distinguishing feature between the two forms of strumous infiltration is, therefore, obvious. In the *diffuse* variety the entire surface of the head of the bone is more or less included; while in the *circumscribed* form the morbid deposit is insulated by healthy osseous structure; and, provided the islands of disease be removed, little doubt need exist of ultimate reparation succeeding, more especially if the powers of nature be such as to encourage prompt and healthy action. The questions of practical interest connected with the treatment of cases answering to the above description are twofold. Firstly, how far is it possible to recognise this affection, and what condition of the joint not only justifies, but demands interference? Secondly, what operation is best suited for the eradication of the disease, the comfort, and advantage of the patient?

I have already remarked that the correct diagnosis of joint-disease is frequently obscure and difficult, and, as far as I am aware, no series of symptoms, or any one apparent distinguishing particular, is sufficient to warrant the surgeon in offering, at an early period, a precise and definite opinion as

to the existence of this affection. Obviously this assertion holds good. Circumscribed strumous infiltration of the extremities of either of the long bones forming the knee-joint may exist for an indefinite period before causing any serious discomfort to the patient, by involving, in a structural or even sympathetic way, the functions of the articulation. As the disease progresses, pain and annoyance may direct the attention of the patient and his surgeon to the existence of mischief within the bone, but no decided fear may be entertained till the irritation spreads to the joint, and the disturbance and distress become more marked. This aggravation is, in general, incidental with the occurrence of suppuration or ulceration; and provided one of these destructive processes advance towards the joint, the inclusion of the articular cartilage and its bony lamella is sufficient to explain any increase of symptoms. When once the cavity of the articulation is opened by bordering ulceration, the real mischief of the disease becomes more apparent, and the tissues within partake of the general disturbance. It is at this advanced stage of the affection that the symptoms exhibited are analogous to those dependent on destruction of the articulation by the more diffuse variety of strumous infiltration; and the various alterations that take place within the joint, and the tissues external to it, are so nearly identical with those I have already described, when adverting to this form of disease, that a repetition would be needless. The somewhat numerous cases of strumous affections of this particular joint which have fallen under my own immediate observation, induce a corroboration of the opinion that a correct diagnosis is oftentimes a most difficult and unsatisfactory undertaking. Detailed symptoms, which are looked for as the headlands to enable the surgeon to arrive at a just distinction, are frequently wanting, or so obscured and mutilated by accompanying complications, that, even if existing, are of comparatively little value as diagnostic signs. Frequent opportunities of observation have also satisfied me that this particular affection of the knee-joint is, by no means, easily



distinguishable in its earlier stages; and although the experienced surgeon may occasionally be led to expect the precise nature of the disease, he cannot always be certain of the true condition till subsequent opportunities afford an ocular proof of the correctness of his surmises. The recognition, however, of this affection in its earliest ravages is not of importance for the present purpose; for it is not till the functions of the joint apparatus become seriously involved, and hopelessly incurable without operation, that the surgeon attempts to discuss the merits of two distinct operative proceedings for the relief of his patient. But it is imperative that the surgeon should be able thoroughly to appreciate the real condition of a joint which is suffering disorganization, and should be capable of offering an opinion to the sufferer which includes the best advice, not only as regards immediate safety, but ultimate comfort and convenience.

An amount of uncertainty and difference of opinion has always existed regarding, what may be termed, the ultimate treatment of a joint implicated by "white swelling." While some authorities have advocated recourse to the amputating knife at a somewhat premature stage of the affection, others, no less distinguished, have preferred waiting till time should more fully demonstrate the incurable nature of the disease; and thus while frequently "hoping against hope," and striving to avoid one extreme of practice, have fallen into another, and, perchance, a graver error.

The conflicting opinions which are entertained regarding the powers of nature to create repair when the functions and organism of a joint have been seriously involved, naturally lead to great misconception as to the propriety of adopting decisive measures on those occasions, when chronic disease has involved for a considerable period the articulation. It would be impossible to attempt to lay down any definite rule to be followed in every case; but be it observed that, when once the exact nature of a diseased joint is recognised, it becomes a less difficult matter to decide upon a precise line of treatment.

I believe the two most self-incurable affections of the knee-joint to depend upon a strumous or pulpy degeneration of the synovial membrane—such a condition as was first accurately described by Sir B. Brodie; and a strumous or tubercular state of the spongy articular extremities of the bones with subsequent inclusion of the articulation. No palliative treatment, as external applications and zealous attendance to the general health, will be sufficient, permanently, to amend either of these conditions when once established. Consecutive inflammation, with suppuration, and perforation of the joint, may, in a certain number of instances, accord to the patient a reprieve, and, perchance, an escape from the knife; yet, I believe, a judicious operation, as excision of the vitiated articulation, will, in general, be the wisest and most satisfactory proceeding. Many, whose opportunities of observation have been limited, will, I am aware, object to the adoption of such measures, as a general rule; but when experience dictates advantages and success, misapplied opinions, and wedded adherence to ancient practices, must, of necessity, succumb. Although, as I before remarked, it would be impolitic to attempt to frame regulations to be observed in the treatment of knee-joints, the integrity of which has been seriously involved by the long existence of this special form of strumous disease, yet there is a tolerably distinct line of treatment which will, on numerous occasions, at least, suggest itself to the essentially practical surgeon; and although every case presenting in a long experience of practice may be characterised by some peculiarity, yet certain features always exist, and pre-eminently elicit the foremost consideration.

When disease has lasted for a protracted period, and its correct character has been surmised; when the destruction to the functions of the joint is complete, and no hope can be entertained of reparation proceeding in such a way as to afford the patient a legitimate chance of immunity from further encroachment, and a satisfactory recovery with a good and useful limb; when the retention of the decayed joint begins to annoy the system, and gives rise to fears that a

similar affection may develope itself elsewhere,—then, without doubt, the judicious surgeon is bound to interfere, adopting measures decisive, but calculated to give to his patient as little deformity and inconvenience as possible. I am by no means disposed to gainsay the fact, that cases of extensive, and, at one time, apparently, incurable diseased knee-joints do not occasionally get well without surgical interference—yet these are exceptions; and while, in a few instances, a beneficial result follows, a far larger proportion sink through neglect and procrastination.

Having considered what operation is best suited for the removal of a knee-joint destroyed by this form of disease, it is encouraging to be enabled to strengthen theories by facts, and give a more general denial to opinions far too widely entertained, and too freely promulgated.

It has long been a point of discussion whether isolated strumous cavities in the heads of cylindrical bones are ever repaired. Judging from Museum preparations, such a result might be considered of not very frequent occurrence, although it cannot be denied that reparation does occasionally take place. My own conviction is, that nature more often replaces the destroyed structure, or, speaking with greater correctness, provides an excellent substitute, than is generally supposed; and my friend Mr. Chalk, who for several years enjoyed a very considerable experience at the Royal Sea-Bathing Infirmary at Margate, inclines to the same impression. When the foreign material deposited in the spongy texture is eliminated, either into the neighbouring articulation, or by perforation through the shaft and periosteum, a strong effort of repair is made by nature, influenced in kind and degree by various circumstances, as the amount of damage inflicted, the constitutional powers of the patient, etc. The character of this repair varies. The membrane lining the cavity may alter in structure, and becoming tougher, and increasing in size, take the place of the extruded material. A tissue, more or less fibrous, may fill up the empty cavern, and act as the mother structure,



which generates the new bony material. Or, provided the lining membrane be removed, there is, perhaps, no reason why the healthy margins of bone should not supply the want of osseous substance. During the time that the deposition and subsequent elimination of this morbid material is going on, accompanying inflammation alters the conditions of surrounding parts. The bone immediately circumscribing the cavity becomes more compact and consolidated in character, less vascular, and paler than is natural. Such are the beneficial changes that may take place; but it not unfrequently happens, especially when the affection occurs in delicate and ill-nourished children, that little or no reparative action follows for some considerable time, while a thin, unhealthy, sanguineous fluid is poured out through fistulous channels, more or less indicative of existing caries.

The reparative changes, however, that do succeed under favourable circumstances are sufficient to encourage a hope, that, taking away the entire disease by art, when a demand is made for removal of the destroyed articulation, will enable the surgeon to give his patient a useful limb, and so prevent a resort to the dreadful expedient of amputation. Associated with the treatment of this form of disease by removal of the joint by excision, are the names of Fergusson, Jones of Jersey, Barnard Holt, Henry Smith, and many others, equally familiar in the history of modern and conservative surgery. I have myself also resorted to the operation, and with signal success. By adducing a short history of some successful cases which have been treated, I trust I shall be doing more to convince those members of the profession who are still obnoxious to the operation and its application, than by the most enthusiastic recommendations based solely upon theories and expectations.

*Case 1.*—Mr. Fergusson, on March 1, 1856, at King's College Hospital, removed the knee-joint of a young woman, aged 20. About three-quarters of an inch of the femur and tibia were removed. In the centre of the head of the tibia,

was a cavity filled with purulent and scrofulous matter. The chief mischief was confined to the head of this bone, the condyles of the femur being but secondarily affected. This girl made an excellent recovery to health before leaving the Hospital, which she did some few months after the operation ; but the connecting medium between the surfaces of the bones was anything but firm, and it was not till refreshed and improved by a residence in the country that the union became solidified by osseous material. This case is alluded to by Mr. Butcher, in his second excellent memoir on "Excision of the Knee-joint," as showing the "certainty of improvement in the condensation of the parts around, and in the vicinity of the excised joint, as time advances."

*Case 2.*—Mr. Jones, of Jersey, removed the knee-joint of a boy in 1851. The case is honoured with a place in the "Royal Medico-Chirurgical Transactions" for 1854, vol. xxxvii. Mr. Jones, writing to me lately, gives the following graphic description of the conditions of the joint :—"The joint, which had several fistulous openings communicating with the external surface, was distended with thin, grumous, greenish-yellow tuberculous pus. The crucial ligaments were so far disorganised as to break down easily. The semilunar cartilages were dotted over with masses of cheesy tuberculous matter. The cartilages covering the articular ends were injected, vascular, and eroded, and the bones were softer than natural. An abscess, the dimensions of a tolerably large walnut, existed in the external condyle of the femur ; the pus it contained being of a tuberculous character. The bone was extensively gouged all around the space it occupied, and the cut ends brought into apposition. The synovial membrane had undergone a lardaceous rather than a pulpy change, and presented here and there interstitial tuberculous deposits. It was a case of genuine tuberculous disease of the knee-joint and surrounding structures. This patient died two years afterwards, but not with any disease connected with the parts. The connecting medium, on examining the parts, is fibro-cartilage, with osseous gra-

nules interspersed. The attachments to the ends of the bones are in the usual manner."

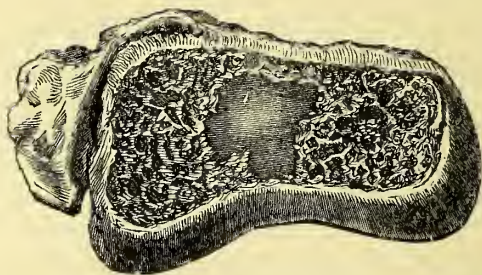
*Case 3.*—Mr. Holt, on the 7th of August, 1854, removed, at the Westminster Hospital, the knee-joint of a little boy, aged 8 years. He had been injured in the knee two years before his admission. Mr. Holt, writing to me on July 30th of the present year, states :—"The disease was unquestionably strumous infiltration of the femur and tibia, with slight ulceration of the cartilages. The operation you saw. I had an opportunity of seeing the child about six months since, and upon examination found the limb had grown in precisely the same ratio as the sound one. He had continued to walk on it ever since he left the Hospital, and can now run as fast as any boy. There is no pain or recurrence of the disease, although I detected one or two sinuses still discharging a thin watery fluid ; but he was so well I could not induce him to come into the Hospital. Upon the whole, I think the case may be considered most satisfactory. The union is perfectly solid : the ankylosis bony."

*Case 4.*—Mr. Henry Smith, on October 18th, 1854, removed the knee-joint of a boy, aged six years. Mr. Smith writes on August 6th, 1857, "I saw the little boy yesterday on whom I performed excision of the knee-joint in October, 1854. I am glad to tell you now that the bones have become perfectly ankylosed with osseous union. As you are aware, in this instance, the union at first was only fibrous, and although the uniting medium was evidently becoming firmer as time advanced, there was some lateral motion for some few months. Now the whole limb seems stiff and staunch. The boy was an eminently strumous lad, and the disease a remarkably interesting one, inasmuch as there was necrosis of the end of the femur—a piece of bone being nearly detached, and a circumscribed strumous abscess of considerable extent in the head of the tibia. The cartilages of the joint itself were ulcerated, and the synovial membrane in a pulpy condition."

*Case 5.*—This case occurred in my own practice, and is re-

ported at length in the *Lancet* for September 13th, 1856. The patient was a girl, aged fifteen, and eminently of a scrofulous disposition of body. She had suffered for five years from disease of the joint. On examining the articular ends of the bones during the operation, the principal disease appeared connected with the osseous structure. One large cavity, containing strumous matter, was situated in the centre of the cut surface of the condyles of the femur; while the head of the tibia was involved by three large caverns filled with cheesy, yellow, tuberculous pus. About an inch of bone was removed from the femur, and three quarters of an inch from the tibia. The cavities were scooped out by the gouge, and thoroughly cleansed, so that, before bringing the bones into apposition, a healthy and bleeding surface everywhere existed. The synovial membrane was almost completely destroyed, and the cartilages removed to a great extent.

The accompanying wood-cuts admirably exhibit the conditions of the cut surfaces of the femur and tibia. I allude with



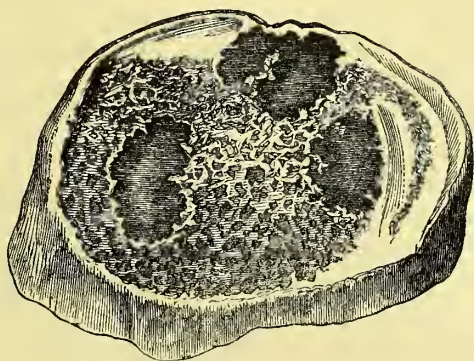
more pleasure to these sketches, as I believe this particular form of disease has not often met with correct delineation; while the frequent adoption of excision for various kinds of disturbance and destruction, has necessitated a more defined and practical appreciation of joint affections.

Bony union, the last time I saw this patient, some three weeks since, was not completed.\* Indeed, I had been some-

\* Consolidation, at the present time (April, 1859), is, apparently, perfect, and has been so for a considerable period.



what surprised that greater condensation had not taken place at an earlier date ; but, knowing what I now do of the subse-



quent history of similar cases, I am the less disposed to regret this want of osseous repair, and more especially as the girl possesses a leg in every way useful. Although bony union is not present to the full extent, the limb is as well nourished as its fellow.

I have selected the foregoing cases, because the details are well known to myself. But equally successful, I make but little doubt, have been other cases which have not so immediately fallen under my own notice ; and, in referring at some length to these successful instances, it has been my aim to promote a great fact in conservative surgery, and forcibly to recommend a proceeding which very intimately concerns a large class of sufferers. But several questions, with great justice, may be asked. One, perhaps, that would first occur, is—Can the whole extent of the disease be removed by this operation ? Without doubt it can ; and for that purpose it is by no means necessary to take away any great extent of bone.

A moderate slice removed from the articular extremity by means of the saw, will, on most occasions, be amply sufficient. A subsequent free use of the gouge and scoop will thoroughly cleanse the cavities of their contents ; and, provided the lining

membrane be likewise removed, and a clean bleeding surface obtained, little doubt need be entertained of reparation setting in. Should the disease be extensive, it may remain a question as to whether sufficient osseous structure still remains to ensure bony ankylosis. I have frequently been surprised to find the amount of reparation that will ensue from a comparatively small nucleus of healthy tissue; and I think little doubt need therefore exist on this point. Again, it is important to ascertain how far implication of the soft tissues around the joint will interfere with the adoption of this operation. I believe that the lesion affecting external parts is seldom so serious as to preclude, for a moment, the propriety of excision. In the hip, for instance, the soft structures around the joint very frequently appear to be more extensively diseased than the articulation itself; but such a state will not deter the surgeon from proceeding with the operation for the removal of the head of the bone, as it is well known that immediately the primary source of annoyance is removed, the infiltrated and distressed tissues will regain their normal condition. But it is not an easy matter to convince every one of the truth of this assertion. Even the intelligent Boyer feared that such a condition might sometimes preclude the adoption of excision, for in his "*Leçons sur les Maladies des Os*," he writes:—"The excision of the carious extremities of bones cannot be advised in cases of white or lymphatic swellings, except the affection be confined to the articulating cavities, and does not extend far among the soft parts around the joint. If, for instance, the cellular substance and the ligaments which are about the knee be loaded with lymph, and be so changed in structure as to have become a homogeneous and lardaceous mass, the extirpation of the joint, as proposed by Park, would obviously be impracticable. This bold operation can only be done when the bones alone are affected."

From my own inquiries and observations, it would appear that primary union between the cut surfaces of the bones, in this disease, is generally fibrous and flexible, but may ulti-

mately become osseous. The details of the foregoing cases prove that such is, in reality, to be expected. On some consideration, this can readily be understood. But such a preparatory termination, if I may use the expression, does not, in the least degree, militate against the operation. I again state that I have seen very useful limbs where the bond of union has been principally of a flexible and non-resisting material; but, as far as present experience proves, a solid junction is much more to be desired. I cannot myself lean to the somewhat exploded notion, that provided a strumous joint be removed, the disease is more prone to be transferred to some neighbouring articulation, or to some internal organ of the body. My individual experience forbids such belief, and I surmise the majority of modern surgeons incline to the same opinion. Why the nutrition of the limb should not continue after the removal of the destroyed joint, I am at a loss to conceive; for no damage has been inflicted upon the main channels of circulation through the member. Yet it cannot be expected that an extremity, which, for some years, has been pining and wasting away, will, immediately on removal of the cause which has gradually led to such a change, regain the form and vigour of its fellow. Time, however, will enable the affected limb to regain its former health.

Mr. Holt's case, and likewise my own, prove that nutrition will accord to the patient a seemly and well-nourished leg; while Mr. Butcher records instances in which this happy result was generally the rule, and not the exception. The existence of one or more small sinuses in the soft tissue communicating with the bone, is really of no importance. Unfortunately, when no greater objection to the operation of excision could be raised, this slight blemish has been seized upon, and magnified into a great and important feature.

Many have not scrupled to condemn the operation on account of the length of time that may elapse before the patient can make use of the limb. The patient, and not the surgeon, however, is the party chiefly interested; and, pro-



vided no great additional risk is incurred by a somewhat protracted confinement, few, I imagine, a short while afterwards, will feel disposed to exchange the advantage they possess—the retention of a useful extremity—for the slight amount of extra time that may have been necessitated for the perfect success of the operation.

Improvement in the subsequent management of the limb has done much to curtail the time that is required for the healing process to take place, so that, not unfrequently, the patient is placed on an equal footing with a less fortunate sufferer, who undergoes amputation of the thigh.

Most of the cases answering to this special form of disease which have been submitted to this operation have been eminently successful in their results. I think an explanation is without difficulty afforded. The peculiar temperament of the generality of patients suffering from strumous affections of the larger joints is favourable for recovery after operations of magnitude. The age with which these affections are most frequently associated tends likewise to success; while the changes that have taken place in the osseous structure of the extremities of the bones lead to the expectation that no violent inflammation will induce hasty destruction to the bony surfaces and their investing periosteum. Indeed, want rather than excess of action is more likely to create anxiety, and I have seen more than one fatal termination which, probably, would not have resulted had the patients possessed less strumous and cachectic dispositions.

Looking carefully and discriminatively back upon the experience I have enjoyed in treating and watching cases in which the operation of excision has been performed upon this special joint—for it has been my great good fortune to have studied this proceeding on many occasions—I cannot but record my belief in favour of its more frequent adoption; and, perhaps, in no instance is it more beneficially resorted to than in cases answering to the description of circumscribed strumous infiltration of the heads of the two bones forming the joint.

## OBSERVATIONS ON THE MECHANICAL TREATMENT OF THE LIMB AFTER EXCISION OF THE KNEE-JOINT.

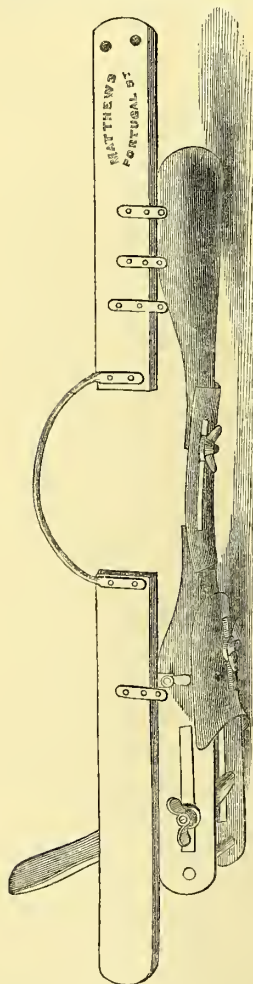
It is with a view of improving the plans for the general management of a limb, after excision of the knee-joint, that I venture to direct attention to the following method.

From the first time I saw this operation, at its revival by Mr. Fergusson, at King's College Hospital, I have been deeply impressed with the importance of correct after-treatment, and I believe that many of the unfortunate results that have occurred are traceable to subsequent mismanagement. An experience of numerous cases of this operation, the majority of which were under treatment at King's College Hospital, the remainder occurring in my own practice, and that of other surgeons, has induced me to call general attention to what I consider the best method of "putting up" the limb, and I know of no way better calculated to give satisfaction to the surgeon and his patient than the one to which I wish to give publicity.

The treatment of a compound fracture of the lower extremity in many ways resembles that necessary for an excision of the knee-joint, and a brief consideration of the points necessary to be observed on such occasions will enable the surgeon to treat with precision those cases of the operation which may fall under his notice. It is important that a strict continuity of surface be preserved between the cut extremities of the bones, and that no undue influence, as muscular action or faulty mechanical appliances, be allowed to displace or injure their surfaces. It is also necessary that the limb be kept at perfect rest, that the absence of all motion may tend to prevent the accession of a train of symptoms, which are but too apt to arise when this feature is overlooked.

The splint represented in the accompanying wood-cut is the one I am in the habit of employing, and is, in many respects, similar to the kind in general use at King's College Hospital. It is made by Messrs. Matthews, of Portugal-street.

It will be seen at a glance that the apparatus is an improvement on the ordinary M'Intyre splint. It consists of two con-

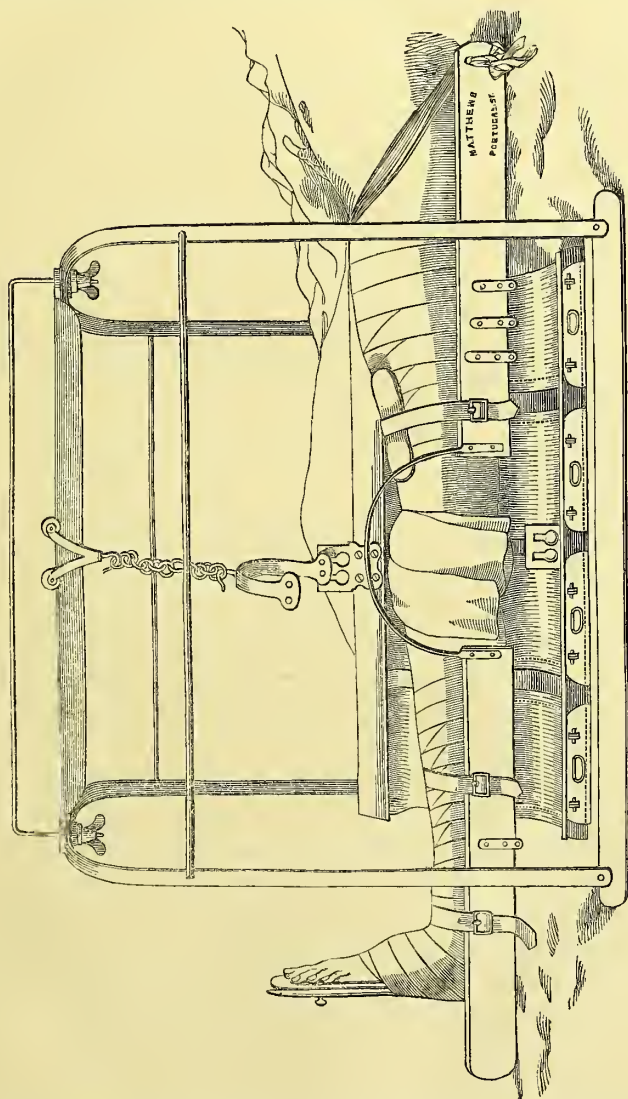


cave portions, the upper part corresponding to the lower half of the posterior surface of the thigh, and the other to the entire length of the leg. These two portions are connected by a narrow plate of the same substance as the splint, which is of enamelled tinned iron, and when in position corresponds to the popliteal space. The lower end is provided with a wooden foot-board, which can be regulated by means of a screw and slide to suit the length of the limb. The plate connecting the upper and lower portions, together with the part corresponding to the lower third of the leg, can likewise be regulated according to convenience.

When the splint is in position, it will be noticed that sufficient support is given to the popliteal space by this narrow plate, and at the same time no obstacle is offered to the daily dressing of the sides of the wound. By the sliding arrangement of the portion of the splint corresponding to the lower third of the leg, a space is left between it and the foot-board, so that the heel,

which is very liable to become affected by the slightest pressure, when the patient has been confined to bed for a length of time, is left perfectly free. I have had, on more than one occasion, to regret the formation of a sore over

the insertion of the tendo-Achillis, which has acted injuriously as a troublesome source of irritation.



The outer side of the splint is provided with hooks, whereby



a long side-splint of wood, furnished with corresponding eyes, may be fastened. This splint ought to extend about two or three inches below the foot-board, and to reach a little higher than the crest of the ilium. I have had the two portions connected by a strong round iron hoop, which, if made sufficiently high, enables the wound to be dressed without the inconvenience of disturbing, in any way, the apparatus. The hoop or arch also answers the purpose of a cradle in keeping off the bed-clothes when the limb is not placed in a swing. All the advantages of the long-splint are thus gained, without the inconvenience of daily removal, and the liability of injurious pressure being made on the outer margin of the wound, in instances where there is great swelling of the soft tissues. The use of the side-splint is the same as in fractures of the femur. By it, in conjunction with the perineal band, extension of the thigh is regulated, and the entire limb kept perfectly at rest.

Both splints, with a slight alteration as regards the situation of the hooks and eyes, are applicable to either limb.

The following are a few of the principal points to be observed in placing the limb upon the splint. I think it is better for the patient to be carried to bed immediately after the operation, and to allow a recovery from the chloroform and the direct effects of the operation prior to placing the limb in the position in which it is to remain. During the interval, the entire limb should be carefully supported, so that all motion and rubbing of the bones is avoided.\* Previously, the splint ought to be lined with a soft cushion or pad, made of wool, and encased in oil-silk. This should be fitted with nicety, as there is seldom need to change it for many weeks. The limb being cleansed of all blood marks, one assistant steadies the thigh, making some degree of traction of the limb towards the patient's body, while another

\* A further experience in the management of these cases has convinced me that the wiser plan is to place the limb in position before the patient is removed from the operating table; and I now strongly insist upon the advantages of so doing.

firmly grasps the leg, and prevents, by means of some extension, the liability of the tibia to be jerked against the femur by the spasmodic action of the hamstring muscles. It will frequently occur, especially when the hamstring tendons have not been divided, that, though due care be taken, there may still be a great tendency of the head of the tibia to be drawn below the level, and even behind the cut surface of the femur. To prevent this, I have found it advisable either slightly to arch the plate of metal which connects the two portions of the splint, or else to place an extra pad in the situation which is to be occupied by the upper portion of the tibia. By this simple arrangement, the upper portion of the bone is tilted upward, and lies in better apposition with the corresponding surface of the thigh bone, which, as I shall recommend, is itself prevented from tilting upwards by the application of a small splint over its anterior surface.

At one time I was somewhat in doubt whether the bony surfaces ought to be brought quite into apposition, or whether it would not be prudent to allow a small space to interrupt their continuity. My objection to the former plan was, that I have known bad results to follow the continual pressure of the cancellated portions of the bone upon each other. Such pressure is strictly to be avoided when the bone is soft and inflamed, especially in that condition termed strumous. This pressure is more or less dependent upon the action of the hamstring muscles. I have, however, since been inclined to alter my views regarding this point, and it is principally from the great value I place upon the facilities of the splint represented above. If due care be taken in placing the limb upon this apparatus, the bony surfaces can be satisfactorily adapted to each other, and with such precision that no undue influence will be able to affect them. The closer the fragments of a bone are brought together in an ordinary fracture of the extremities, the better, in general, will be the ultimate result. So it is, I believe, with the union of the bony surfaces after the operation of excision, and provided the bones can be brought

and maintained in actual apposition, without infliction of injury on the cancelli, the greater will be the chance of bony, and not fibrous union. To ensure a strict attention to this feature, I am in the habit of fixing the foot firmly to the foot-board before rolling the leg to the splint. Previously the leg and lower portion of the thigh should be bandaged, whereby any tendency to œdema is counteracted, and the fretting of the skin by the oil-silk avoided. Before the leg is fixed by bandages it will be prudent to see that the entire limb is in a right position. The same precautions are necessary as in dressing a severe fracture. The most comfortable position for the foot is semiflexed, as neither set of muscles are unnecessarily taxed. The same bandage that fixes the foot to its support should be carried up so as to confine the lower limb to the splint. The thigh is, in a similar way, fastened to the portion of the splint hollowed out to receive it. Suitable pads will be found a great acquisition in filling up the interstices between the limb and its support. Over the front surface of the thigh should be placed a small splint, duly padded, and retained in position by means of straps of webbing furnished with buckles. The side-splint, previously covered with some soft material in those parts which come in contact with the skin, is now applied to the outer side of the limb, and a requisite amount of extension made by means of the perineal band. It is also kept in close contact with the limb by means of straps of webbing. The wound is covered with water-dressing, which, as will be seen by the accompanying wood-cut, can be easily changed without inconvenience or trouble. I cannot too strongly insist upon the value of the side-splint. In adults, its use is chiefly to assist in maintaining the bones in apposition, although it is not imperative. In young children, however, who cannot be expected to see the advantage of remaining quiet, and thus greatly facilitating the endeavour of the surgeon, it is of the utmost importance. I have, in one instance, carried the splint almost into the axilla, and, by means of a pad and bandage, fixed it firmly to the upper part of the trunk, so that all the endeavours of my little



patient, which would otherwise have tended to disturb the apposition of the bones, were successfully combated.

In recommending this plan of treatment for excision of the knee-joint, I wish it to be understood, that I do not discredit the value of the older method of the box-frame, which I have seen used with good effect; but I wish to bring publicly before the profession an apparatus, which, if judiciously employed, will tend very greatly to facilitate the after-management of this interesting operation. I have sufficient grounds for stating that many of the evils which have arisen after the performance of this operation have been frequently owing to the imperfection of the subsequent treatment. A single long splint, which has to be removed daily to admit of dressing the wound, is surely an incomplete apparatus? Leaving the limb altogether without support from a splint for many days, is not, as far as I can see, attended with much advantage; whilst the use of pillows, side-splints, sand-bags, and starch bandages, with other appliances equally faulty, in many respects, cannot but tend to render the subsequent management of the limb a difficult and tedious process. It is to be hoped that, for the future, more attention will be given to each step of the treatment; and that it will be worthy of remembrance that the greater the amount of attention to this point, the more satisfactory, oftentimes, will be the ultimate result of the operation. Amputation of the thigh, and other unwished-for terminations, will then less frequently follow our laudable efforts to preserve a good and useful limb.

The swing represented in the wood-cut is that known as "Salter's Swing," the useful invention of my friend, Dr. James Salter. It is now so extensively used in the scientific treatment of fractures and other injuries of the extremities, and its comfort is so great to the patient, that it becomes, in my own opinion, quite a necessary appendage to the other portion of the apparatus, employed in the manner I have recommended. My friend Mr. George Parkinson, whose name I mention with great satisfaction, as intimately asso-

ciated with the use of this apparatus in its early form, Messrs. Goodall, Heath, Swayne, Liddon, Walters, and other talented house-surgeons to King's College Hospital, have found the best results follow its judicious application ; and I have no hesitation in affirming that the success attending future cases, in which the operation may be undertaken, will, in a great degree, depend upon its employment.

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SOME OF THE CAUSES WHICH HAVE OCCASIONALLY RENDERED EXCISION OF THE KNEE-JOINT MORE OR LESS UNSUCCESSFUL.

THE operation of excising the knee-joint, when involved in disease, deformity or accident, has lately much engrossed the attention of enterprising surgeons. That it may be practised with the greatest possible advantage, it is advisable that those who undertake to perform it, should be conversant with certain features hitherto exhibited in those cases which have, unfortunately, not realised the hopes of the operator.

Although the successes and misfortunes attending its adoption have occasionally been judiciously recorded, and thereby served as beacons and examples in subsequent repetitions, still little doubt can be entertained that much valuable information has remained unpublished and untold. Early instructed and convinced as to the value of this proceeding over amputation of the thigh, on very many occasions, for the treatment of diseased conditions of the articulation, I endeavoured, for some years, to possess myself of various facts which have strengthened the early impressions of its merits. Unusual opportunities have afforded me ample scope for personal study ; while I have eagerly embraced every occasion which could offer additional information and experience.

Being thoroughly satisfied of the real advantages and high character of the operation, I became anxious to see it placed upon a still firmer basis than that reared by the labours of many enthusiastic surgeons. I conceived that the most eligible and satisfactory way of so doing would be to collect

as large a number of the cases operated upon as possible ; and, obtaining unquestionable details of each individual instance, honestly record the information I had acquired. The courtesy and kindness of many surgeons, who have resorted to the proceeding, has enabled me to do so ; and I trust the observations I now offer may lead to a better and more general acquaintance with, not only its utility and advantages, but its failures and successes.

I by no means assert that I have possessed myself of every detail relative to the operations which have been performed during the past eight years in this country and in Ireland. There must, of necessity, be forthcoming records ; but the information I have acquired being much more extensive than any yet published, I am unwilling further to delay its more universal diffusion.

During the period extending from July, 1850, to the end of 1858, I have collected one hundred and sixty cases of the operation which have been performed by British surgeons in their own country ; and the following analysis of the entire number will, I trust, elucidate facts of considerable interest and value.

I am unable positively to say whether the statistics I shall adduce are, in every particular, quite correct ; but if I have been unsuccessful in obtaining a clue to the unpublished accounts of a few cases, it has been owing to no lack of desire on my part. Should I discover any serious flaw in my calculations, which, in one way or the other, may affect the merits of the operation, I shall be only too happy to rectify the mistake at no distant period, when I hope to bring this important subject still more fully before the profession.

In the compilation of the following observations, I stand deeply in debt to the able memoirs of Mr. Butcher, Mr. Humphry, Mr. Jones of Jersey, Mr. Henry Smith, &c. From the columns of the various Medical Journals, I have freely drawn valuable information ; while I cannot too gratefully acknowledge the prompt and ample replies I have obtained to my numerous inquiries from various surgeons. My special object in the following essay is to illustrate some of the causes

of failure which have followed the removal of the articulation. In so doing, I have but one aim—a desire to assist in obtaining for the operation that place in practical surgery, to which, I believe, it is fully entitled.

The operation of excising this joint may prove either completely or partially unsuccessful. When completely unsuccessful it is followed by death, or amputation of the limb; and when only partially successful, the limb, although freed from the cause of former annoyance, remains, more or less, a useless member. Before entering into the various causes of failure, I will briefly state the statistical results at which I have arrived.

The operation, so far as I have been able to ascertain, has been adopted for the treatment of diseased conditions of the knee-joint, deformity, and accident, on 160 occasions, in Great Britain, during the past eight years, dating from its first performance by Mr. Fergusson on the 20th of July, 1850, to the end of December, 1858. Of the total number of cases, 160, 32 proved fatal, or one case in every five. By far the larger proportion of these operations were required for disease; for out of the entire number there were but six or seven for deformity, and only one for accident, which occurred in the practice of Mr. Canton, of Charing-cross Hospital.\* The age of the youngest patient was 3 years, under the care of Mr. Kendall, of the Norfolk Hospital;† that of the oldest 47 years, a patient of Mr. Holt, of the Westminster Hospital.‡

When the operation was resorted to on account of disease, statistical data show that the joint was very extensively involved. In by far the larger proportion of cases the osseous structures, as well as the synovial and cartilaginous, were included. Mischief, as a rule, and the exceptions are few, had existed for years. In some instances the articulation had been impaired for lengthy periods, and a persistence of milder means would have been not only futile, but highly injudicious

\* *Lancet*, August 28, 1858.

† *Medical Times and Gazette*, June 5, 1858.

‡ *Lancet*, September 13, 1856.

and unsurgical. It may with safety be affirmed, that in every case, judging from description, and oftentimes from personal observation, excision was only adopted as a *dernier ressort*; and although, on some occasions, amputation, as results verified, would have been the wiser proceeding, still I am anxious in my endeavours to release many operators from an imputation which has been far too readily credited,—that the operation has been frequently jumped at when there existed few or slight grounds for its employment. When it was resorted to on account of deformity, its adoption evinced the humane efforts of the surgeon, who zealously endeavoured to restore to the unfortunate sufferer the utility of a crippled member.

Amputation was required on eighteen occasions, at a more or less distant period after removal of the articulation. In one case only was the proceeding, as far as I am aware, followed by a fatal result. I shall more in detail allude to particulars when adverting to the necessity of amputation as one of the causes of failure.

Death occurred from the following causes, and in the order of frequency in which they are stated :—

From Pyæmia . . . . .	8 cases
Exhaustion . . . . .	6 „
Irritation . . . . .	5 „
Shock . . . . .	4 „
Dysentery . . . . .	1 case
Suppression of Urine . . . . .	1 „
Pleuro-Pneumonia . . . . .	1 „
Erysipelas . . . . .	1 „
Peritonitis . . . . .	1 „
Acute Phthisis . . . . .	1 „
After Amputation . . . . .	1 „
Causes Unknown . . . . .	2 cases
<hr/>	
Total . . . . .	32

Firstly. With regard to those cases which terminated fatally from pyæmia. In the eight instances recorded, five occurred in the practice of Mr. Fergusson, at King's College



Hospital, at various intervals during the eight years.\* The late Dr. Mackenzie lost a patient from undoubted pyæmia.† Mr. Tatum, of St. George's Hospital, operated upon a lad, 18 years of age, who sank on the seventeenth day;‡ and the remaining case, under the care of Mr. Mead, of Bradford, proved fatal on the thirteenth day.§ The pyæmic symptoms manifested themselves at various periods, and proved fatal, from the eighth to the seventeenth day after operation. The age of the patients who sank from this cause averaged from 12 to 30 years. Five of the patients were males, and three, females.

In the six instances recorded, in which simple exhaustion, or exhaustion complicated with diarrhœa, night-sweats, &c., proved the cause of death, two cases, under the care of Mr. Fergusson, both aged 27 years, sank, one the forty-fourth day, and the other, 6½ months after the operation.

Mr. Holt, of the Westminster Hospital, lost a woman, aged 47 years, the case already mentioned, on the eighth day. This patient, previous to the operation, was in a very weakened condition, but removal of the joint was imperative, owing to the depressing nature of the disease. The late Dr. Mackenzie operated on a lad, aged 18 years, who sank from a combination of these causes.|| Dr. Cotton, of the West Norfolk Hospital, lost a girl, 16 years of age, in the ninth week, from the operation;¶ and Dr. Masfern, of the Stafford General Infirmary, a patient, 37 years of age, on the twenty-first day after removal of the articulation.\*\*

Irritation, both local and general, associated with fever, abscesses, diarrhœa, &c., and in one instance, with diphtheria, occurred as the cause of death in five instances.

Mr. Humphry, of Cambridge, lost a little girl, 5 years of

\* When reference from whence the particular source of information was acquired is not stated, I have gained it from personal observation, or from private communications.

† Butcher's First Memoir on Excision of the Knee-joint, page 17.

‡ Lancet, vol. ii. p. 281, for 1856. § Medical Times, May 8, 1858.

|| Butcher's First Memoir, p. 16. ¶ Medical Times, June 5, 1858.

\*\* Medical Times, May 8, 1858.

age, in the third week, who had severely suffered from acute suppuraton of the joint, and for which the operation was performed.\*

A man, aged 26 years, upon whom Mr. Quain operated in University College Hospital, sank on the thirteenth day.†

Mr. Bowman, of King's College Hospital, operated upon a patient, 30 years of age, who, from a combination of these causes, died in the course of some few weeks.

Mr. Ure, of St. Mary's Hospital, informs me that a patient, aged 24 years, whose knee-joint was removed, sank from irritation, and a violent attack of diphtheria, on the twenty-fourth day. Secondary hæmorrhage greatly complicated the earlier treatment of the limb. I assisted my friend Mr. Hoffman, of Margate, to excise the knee-joint of a girl, about 15 years old, who died on the fourth day.

The age of the youngest patient who died from one or other of these conditions was five years; that of the oldest, thirty years. Death occurred, as already stated, in one instance, on the fourth day, but in others it was more protracted.

Death, arising from the shock of the operation, took place on four occasions. In two cases, under the care of Mr. Ferguson, in King's College Hospital, the symptoms were more or less masked by the exhibition of amylene and chloroform. The former agent was administered at the time of the operation, the latter after a lapse of an hour or two, for the purpose of adequately adjusting the limb. In one instance—that of a little girl, 6½ years of age—death took place within seven hours of the operation. The other patient was a woman, aged 31 years, who expired on the third day. There is but little doubt, in my own mind, that the administration of both these agents tended, in a greater or less degree, to the unfortunate occurrence. The third fatal example was in a patient, aged 26 years, under the care of Mr. Moore, of Middlesex Hospital. Secondary hæmorrhage gave some

\* Med.-Chirur. Trans. vol. xli. p. 203.

† Butcher's Second Memoir, p. 37.

trouble, but obstinate vomiting continuing, he sank on the fourth day. Mr. Brace, of Bath, lost a man, 27 years of age, in twenty-four hours after the operation.

Dysentery, suppression of urine, pleuro-pneumonia, erysipelas, peritonitis, and acute phthisis, have each caused the death of a patient. One case succumbed after amputation had been adopted.

Dysentery proved fatal to a lady, 30 years of age, a patient of Mr. Jones, of Jersey, on the thirteenth day.

Suppression of urine was the chief complication which rendered the operation fatal, on the thirteenth day, in a man, aged 21 years, under the care of Mr. Fergusson.

A woman, a patient in Mr. Fergusson's wards, suffering acutely from disease of the left knee-joint, although her lungs were detected to be in a very precarious state, urged removal of the diseased articulation. Excision was performed, and she progressed well for some days, but on the eighteenth day was carried off by an attack of acute phthisis.

An adult patient, under my own care, at the Great Northern Hospital, succumbed to a very severe attack of pleuro-pneumonia, on the thirty-first day.\* A man, Mr. Walton informs me, under his care in St. Mary's Hospital, progressed satisfactorily for some time after the operation, when a sudden attack of peritonitis soon destroyed life.

Erysipelas, after considerable union had taken place between the divided bones, and the operation had promised to turn out satisfactorily, destroyed the patient, a man under the care of Mr. Henry Thompson, in University College Hospital, at the sixth week.

Mr. Windsor, of the Salford Hospital, lost a patient, 18 years of age, five months after excision of the joint. Amputation was required four months after the previous operation, from which the patient sank. Secondary hæmorrhage proved troublesome after removal of the articulation, and some exfoliation took place.† Mr. Bickersteth, of Liverpool, has,

\* *Lancet*, January 9, 1858.

† *Medical Times and Gazette*, November 29, 1856.

I believe, lost two cases ; but from what causes I have been unable to ascertain.

On reviewing these thirty-two unsuccessful results of the operation, various considerations are suggested. Pyæmia, it is seen, proved fatal in one-fourth of the cases, and was the most frequent cause of death. In comparing this result with the statistics lately brought forward in a most able paper, lately read before the Royal Medico-Chirurgical Society, by Mr. Bryant—"The Causes of Death after Amputations"—it appears that pyæmia was the principal cause of fatality ; and proved so in 300 cases of amputation, of both the upper and lower extremities, in 43 per cent. of all fatal cases ; and in 5·4 per cent. of all pathological amputations ; and when fatal, as a rule, caused death within fourteen days of the operation.

It must also be borne in recollection, that five out of the eight cases occurred in one London hospital. Exhaustion and irritation proved fatal in nearly the same proportion ; but in more than one instance the patient was in an enfeebled condition prior to the operation. Shock, which is so frequent a cause of untoward results in amputation, is by no means a common sequel to excision of this special joint ; and though four patients sank from its severity, still, as already observed, it was materially heightened, in two cases, by serious complications.

The general absence of severe shock following the operation is a feature worthy of great consideration. Mr. Humphry, who has resorted to this proceeding on sixteen occasions, distinctly calls attention to these facts.\* Mr. Jones, of Jersey, also informs me that his experience in fifteen cases leads him to the same conclusion ; while my own researches allow me to corroborate the correctness of these opinions. The other causes which carried off the remaining eight patients were totally beyond the control of the surgeon, and such that are liable to occur after any operation of magnitude. In 160 cases, therefore, it is seen that 32 operations

\* Med.-Chirur. Trans. Ibid.

were attended with a fatal result—exactly 1 case in every 5. This result tallies with that obtained by Mr. Butcher, two years since, in half the number of cases.

Mr. Teale, in his excellent memoir “On Amputation by Rectangular Flaps,” states, that in 169 amputations of the thigh for disease in the London hospitals during three years—1854 to 1857—there occurred 38 deaths, or 1 death in  $4\frac{1}{2}$  cases; and in 134 amputations of the thigh for disease, in Provincial hospitals, during the same period, there resulted 33 deaths, or about 1 death in every 4 cases.

In a lecture, “On Surgical Fever,” lately published in the columns of “*The Medical Times and Gazette*,” April 23rd, 1859, Professor Simpson, of Edinburgh, adduces the following statistics of amputation of the thigh, collected ten years ago, accompanied with a just, but much-to-be-lamented conclusion :—

TABLE OF THE MORTALITY OF AMPUTATION OF THE THIGH.

Name of Hospital and Reporter.	Number of Cases.	Number of Deaths.	Percentage of Deaths.
Parisian Hospitals—Malgaigne..	201	126	62 in 100
Edinburgh Hospital—Peacock..	43	21	49 in 100
General Collection—Phillips. . .	987	435	44 in 100
Glasgow Hospital—Lawrie. . . .	127	46	36 in 100
British Hospitals—Simpson. . . .	284	107	38 in 100

“Thus you see that in Paris, where amputation of the thigh was performed, no doubt, in the most approved and artistic manner, and with all the aids of the most perfect handicraftism, more than one-half of the patients subjected to that operation died; while in other hospitals, patients died after the same operation in a less, but still a very high proportion; the general result being, that nearly one in every two patients operated on died.”

Comparing the results of excision of the knee-joint with those of amputation for disease, the percentage of successful cases is certainly in favour of the former operation. When, in addition, the numerous advantages obtained to the patient are duly weighed, few surgeons will presume to deny the



vast superiority of the former proceeding over the latter. Mr. Bryant, however, from the statistics drawn entirely from Guy's Hospital, is enabled to place the satisfactory results following amputation of the thigh at about the same percentage as I have obtained for excision of the joint. He states that 1 case in 5·5 was about the proportion of fatal terminations in pathological "amputations." For "chronic disease" of the articulation, amputation was more favourable, the mortality standing at about 1 in every 7 cases.

Excision of the joint may prove totally unsuccessful without causing death.

In the 160 cases I have mentioned, it was found requisite to resort to amputation of the thigh on eighteen occasions, but, happily, this unpleasant requirement was attended with only one fatal termination. The causes which led to the necessity of such a measure were the following :—

1. The occurrence of non or insufficient union, associated with abscesses of the soft parts, and necrosis of the ends of the bones.
2. The existence of abscesses more or less acute, accompanied with hectic, night-sweats, diarrhœa, etc.
3. Erysipelas, and other specific affections, as measles, etc.
4. Inappropriate management of the limb during treatment.

With regard to the occurrence of the first of these causes. The condition may result from an erroneous selection of the cases for operation. I think I have sufficiently proved this fact, in various essays contributed to these columns. That form of disease recognised as diffuse strumous infiltration of the spongy tissue of the extremities of the bones, and leading to destruction of the articulation, experience has amply shown should never be submitted to excision. Union of an osseous, or even serviceable fibrous character, will seldom or never occur, and the limb will, in all probability, be riddled with sinuses, and demand removal by amputation. A case illustrating such a result has occurred to Professor Keith,\* and a similar one to myself.

\* Medical Times, August 1, 1857.

In the eighteen instances in which amputation was needed, it became necessary to resort to it on eleven occasions, owing to the unfavourable conditions which the local parts had assumed, and to the constitutional disturbance which ensued. The earliest date at which it was needed, was on the ninth day, in one of Professor Pirrie's cases; and the most distant period to which it was postponed, as far as I am aware, was in one of my own patients, when, lingering in hope that I might retain the child a useful limb, I delayed the operation for two years and three months.

In four cases, amputation was demanded on account of erysipelas and general derangement; but the patients made excellent recoveries. In three instances, from incompetent management of the limb, it was found impossible to keep the parts in apposition, and the use of the amputating knife became imperative. On one occasion it was resorted to on the forty-second day after removal of the joint.\*

In the second example, after the lapse of six weeks,† and in the remaining case at the end of the sixth week. In this instance the unfortunate termination of removing the articulation appears to have been much influenced by sloughing, which extensively destroyed the soft parts, although "it was extremely difficult to retain the ends of the bones in proper relation to each other; and the end of the tibia was drawn backwards behind that of the femur."‡

It is well worthy of remark that, out of the eighteen cases which underwent amputation of the thigh, only one terminated fatally.

I have purposely omitted one case, which I was unwilling to admit among the statistics of the operation. The patient was a middle-aged man, suffering from a diseased condition of his right knee-joint, which, to all appearance, was well suited to excision. During the steps of the operation, the operator, Mr. Fergusson, deemed the disease involving the tibia too extensive to be removed in such a way as to ensure a warrantable hope of success, and accordingly changed his

\* *Lancet*, 1856, vol. ii. p. 305.

† *Lancet*, 1856, vol. ii. p. 306.

‡ *Medical Times*, 1857, vol. ii. p. 579.

determination, and amputated the limb, by cutting the flap from the calf of the leg. The patient died from pyæmia, after the lapse of a few days.

The necessity for amputation in so large a proportion of cases submitted to excision of the joint, would naturally, at first sight, engender a feeling unfavourable to the operation ; but on a more mature consideration, it will readily appear that further experience, and a knowledge of the causes of failure, will enable the surgeon to avoid various shoals and mistakes into which, unfortunately, his predecessors have fallen. A careful selection of cases, suitable to the performance of the operation, and a clearer appreciation of the value of correct management of the limb, are points of the highest importance. Mr. Butcher, in the able Memoirs to which I have already alluded, earnestly insists upon the first of these requirements ; while I have the satisfaction of knowing, that the observations I offered with regard to the after-treatment of the limb,\* have been carried out with advantage by many surgeons.

On looking into the early history of excision, from 1762 to 1830, I find that, with few exceptions, the greatest difficulty was experienced in endeavouring to keep the ends of the tibia and femur in apposition ; and that a large proportion of deaths, or partial failures, was the immediate consequence. Professor Roux encountered this difficulty † in the only case which he undertook ; while Professor Syme, in two instances in which he resorted to the operation, found in one, that it was only “after several unsuccessful attempts, that he succeeded, at the end of several days, in reducing the displaced extremities of the bones ;” ‡ and in the other, “in order to prevent displacement of the bones, which all our efforts had been insufficient to effect completely,” two inches more of the femur had to be removed nearly one month after

\* Lancet, January 24, 1857.

† Dictionnaire des Sciences Médicales. Par une Société des Médecins et des Chirugiens. Paris. 1820.

‡ Treatise on the Excision of Diseased Joints, p. 137. By James Syme. Edinburgh. 1831.

the operation.\* From an acquaintance with such facts, it will readily be conceived, why these, and other distinguished surgeons, failed to appreciate the real value of the operation; and how an improved method of management has led to the success anticipated by its first propounder—Henry Park.

Excision of this special joint has oftentimes been followed with merely partial success; for though the disease or deformity may have been removed, the patient has found his limb more or less useless as a means of progression.

The chief causes of only this partial success have been found to result from,

1. Imperfect union of the divided ends of the tibia and femur, arising from a peculiar diathesis pervading the constitution.

2. From the non-maintenance at rest—or inappropriate treatment—of the part immediately concerned in the operation.

3. From taking away too great an amount of bony structure.

4. From the occurrence or persistence of abscesses in the soft tissues only, or complicated with the disease of bone.

I have already alluded to the vast importance of a judicious selection of cases, and the incorrectness of adopting a surgical proceeding in instances which experience has bountifully proved to be ill suited to this kind of treatment.

When a great amount of disease is situated in the cancellous structure of the bone, I believe, as a general rule, the uniting medium will be primarily fibrous and flexible, although it may subsequently become further consolidated by the production of bone. On referring to the history of each individual case submitted to the operation, I found that, in by far the larger proportion, the character of the uniting medium was at first flexible, although it frequently became firmer, and sometimes apparently osseous: notwithstanding the cut extremities of the bones are more often knit together by fibrous substance, still bony ankylosis is a common sequel of excision. It has,

\* Treatise on the Excision of Diseased Joints, p. 137. By James Syme. Edinburgh. 1831.



however, been supposed by some, that an osseous union is imperative before the limb can become useful. Such is the conclusion of theory, and not of experience. In more than one instance, I have witnessed a most admirable limb retained, in which by no means a limited amount of motion existed. Mr. Fergusson, Dr. Cotton of Lynn, Mr. Tubbs of Wisbeach, etc., have each a case illustrative of this fact.

In those instances in which the limb hung as a flail, little or no consolidation had taken place between the tibia and femur. In one instance in which I amputated, in the case already referred to, the ends of the bone had undergone very considerable absorption and alteration in form; and were bound together by bands of fibrous tissue, stretching, not between the cut osseous surfaces, but from the circumference of the shafts.

The character of the union is not unlikely to be materially affected by inappropriate mechanical after-treatment of the limb. I have more than once been a witness of this fact. Analogy also demonstrates its apparent correctness. In excision of the elbow-joint the surgeon's endeavour is to procure a false joint, and to enable him to prevent the occurrence of bony junction, passive motion is employed directly all active inflammation has subsided. If strict apposition of the parts be maintained, osseous union, in a majority of instances, provided there exist no special cause to contra-indicate its formation, will be the result.

Arrest in development of the limb after excision is, I believe, in a very great measure, dependent upon the amount of bone which is taken away, and the age of the patient at the time the operation is performed. I have before alluded to this fact, and Mr. Humphry also lays considerable stress upon the importance of taking these causes into consideration. Should the epiphyses of the bones be removed entirely, there can exist but slight doubt, that arrest of further development will take place. I am aware of one or two instances, in which a want of due attention to this feature has led to an expression of dissatisfaction at the result of the operation. In both adults and children, when only a small portion of the



articular bones have been removed, there has been observed but slight difference in growth after a certain amount of utility had been gained.

In children, more than in adults, the persistence of abscesses in the soft tissues only, or complicated with slight disease of bone, is a common occurrence after removal of the joint. In scrofulous cases, such disturbance has been frequently noticed. It may, however, be kept up by the existence of remaining portions of diseased synovial membrane, or small portions of dead bone. Whatever may be the cause, judicious treatment and patience will generally find a remedy; and experience has already shown that even a very long existence of such a condition is but a comparatively slight drawback to the immediate good effects expected from the operation. I know of several cases in which, nature having exhibited a tardiness in throwing off diseased portions of bone, sinuses have remained open for many months, and although ultimately healing, have been prone to recur. One case, in particular, under the care of Mr. Christopher Heath, well illustrates these remarks.

There are other causes which have formed temporary drawbacks to the operation, but I have mentioned, I think, the more prominent. Swelling of the lower limb and ankle is, however, not an unfrequent disagreeable symptom after removal of the joint. In children, especially, I have noticed this tendency. In all probability, it obtains, owing to some consolidation or blocking up of venous canals by the inflammatory changes which have arisen from diseased or reparative action. Judicious management generally remedies the condition; but I mention it particularly, as I am aware its occurrence is sometimes looked upon in a far too serious light.

These somewhat scattered observations have been strung together in the hope that they might afford some additional information regarding a highly useful surgical proceeding; for, I conceive, it is only by a thorough investigation of the many features pertaining to the operation, that a just appreciation of its value can be formed.



Fig. 1.



Fig. 2.



Fig. 3.

